

1     CLAIMS:

2             1.     A capacitor fabrication method comprising:

3                 forming a first capacitor electrode over a substrate, the first  
4     electrode having an inner surface area per unit area and an outer  
5     surface area per unit area that are both greater than an outer surface  
6     area per unit area of the substrate;

7                 forming a capacitor dielectric layer over the first electrode; and

8                 forming a second capacitor electrode over the dielectric layer.

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10             2.     The method of claim 1 wherein the first electrode comprises  
11     TiN.

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13             3.     The method of claim 1 further comprising forming rugged  
14     polysilicon over the substrate, the first electrode being over the rugged  
15     polysilicon.

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17             4.     The method of claim 3 wherein the rugged polysilicon is  
18     undoped.

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20             5.     The method of claim 3 wherein the rugged polysilicon  
21     comprises hemispherical grain polysilicon.

1           6.     The method of claim 3 wherein the forming the rugged  
2 polysilicon comprises using a seed density sufficiently small to yield at  
3 least some spaced apart grains.

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5           7.     The method of claim 1 wherein the outer surface area of the  
6 first electrode is at least 30% greater than the outer surface area of the  
7 substrate.

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9           8.     The method of claim 1 wherein the forming the first  
10 electrode comprises:

11           chemisorbing a layer of a first precursor at least one monolayer  
12 thick over the substrate;

13           chemisorbing a layer of a second precursor at least one monolayer  
14 thick on the first precursor layer, a chemisorption product of the first  
15 and second precursor layers being comprised by the first electrode.

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17           9.     The method of claim 1 wherein the dielectric layer comprises  
18  $\text{Ta}_2\text{O}_5$ ,  $\text{ZrO}_2$ ,  $\text{WO}_3$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{HfO}_2$ , barium strontium titanate, or strontium  
19 titanate.

1           10. A capacitor fabrication method comprising:  
2           forming an opening in an insulative layer over a substrate, the  
3           opening having sides and a bottom;  
4           forming a layer of polysilicon over the sides and bottom of the  
5           opening;  
6           removing the polysilicon layer from over the bottom of the  
7           opening;  
8           converting at least some of the polysilicon layer to hemispherical  
9           grain polysilicon;  
10          conformally forming a first capacitor electrode on the converted  
11          polysilicon, the first electrode being sufficiently thin that the first  
12          electrode has an outer surface area per unit area greater than an outer  
13          surface area per unit area of the substrate underlying the first electrode;  
14          forming a capacitor dielectric layer on the first electrode; and  
15          forming a second capacitor electrode over the dielectric layer.

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17          11. The method of claim 10 wherein the hemispherical grain  
18          polysilicon is undoped.

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20          12. The method of claim 10 wherein the converting the  
21          polysilicon comprises using a seed density sufficiently small to yield at  
22          least some spaced apart grains.  
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1           13. The method of claim 10 wherein the forming the first  
2 electrode comprises:

3           chemisorbing a layer of a first precursor at least one monolayer  
4 thick on the converted polysilicon;

5           chemisorbing a layer of a second precursor at least one monolayer  
6 thick on the first precursor layer, a chemisorption product of the first  
7 and second precursor layers being comprised by the first electrode.  
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9           14. The method of claim 10 wherein the first electrode comprises  
10 TiN.  
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12           15. The method of claim 10 wherein the dielectric layer  
13 comprises  $\text{Ta}_2\text{O}_5$ ,  $\text{ZrO}_2$ ,  $\text{WO}_3$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{HfO}_2$ , barium strontium titanate, or  
14 strontium titanate.  
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16. A capacitor construction comprising:

a first capacitor electrode over a substrate, the first electrode having an inner surface area per unit area and an outer surface area per unit area that are both greater than an outer surface area per unit area of the substrate;

a capacitor dielectric layer over the first electrode; and

a second capacitor electrode over the dielectric layer.

17. The construction of claim 16 wherein the first electrode comprises TiN.

18. The construction of claim 16 further comprising rugged polysilicon over the substrate, the first electrode being over the rugged polysilicon.

19. The construction of claim 18 wherein the rugged polysilicon is undoped.

20. The construction of claim 18 wherein the rugged polysilicon comprises spaced apart grains.

1           21.    The construction of claim 16 wherein the outer surface area  
2   of the first electrode is at least 30% greater than the substrate outer  
3   surface area.

1           22. A capacitor construction comprising:  
2           an opening in an insulative layer over a substrate, the opening  
3           having sides and a bottom;  
4           a hemispherical grain polysilicon layer over the sides of the  
5           opening but not over the bottom;  
6           a conformal first capacitor electrode on the polysilicon, the first  
7           electrode being sufficiently thin that the first electrode has a rugged  
8           outer surface with an outer surface area per unit area greater than an  
9           outer surface area per unit area of the substrate underlying the first  
10          electrode;  
11          a capacitor dielectric layer on the first electrode; and  
12          a second capacitor electrode over the dielectric layer.

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14          23. The construction of claim 22 wherein the polysilicon is  
15          undoped.

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17          24. The construction of claim 22 wherein the polysilicon  
18          comprises spaced apart grains.

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20          25. The construction of claim 22 wherein the first electrode  
21          comprises TiN.  
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26. The construction of claim 22 wherein the dielectric layer comprises Ta<sub>2</sub>O<sub>5</sub>, ZrO<sub>2</sub>, WO<sub>3</sub>, Al<sub>2</sub>O<sub>3</sub>, HfO<sub>2</sub>, barium strontium titanate, or strontium titanate.